

Notice of Allowability

Application No.

10/655,020

Examiner

Filip Zec

Applicant(s)

HIWATA ET AL.

Art Unit

3744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the Afterfinal amendment dated 2/25/2005.
2. ☒ The allowed claim(s) is/are 1-20.
3. ☒ The drawings filed on 05 September 2003 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

REASONS FOR ALLOWANCE

1. The following is an examiner's statement of reasons for allowance: the prior art does not anticipate nor render obvious the combination set forth in the independent claims, and specifically does not show a refrigeration cycle apparatus using carbon dioxide as a refrigerant, comprising at least three four-way valves connecting a compressor, an outdoor heat exchanger, an expander, an indoor heat exchanger and an auxiliary compressor, wherein said auxiliary compressor is driven by power recovered by said expander, and wherein when refrigerant flows using said indoor heat exchanger as an evaporator, a discharge side of said auxiliary compressor becomes a suction side of said compressor, and when all of said four-way valves are switched over such that refrigerant flows using said indoor heat exchanger as a gas cooler, a discharge side of said compressor becomes a suction side of said auxiliary compressor. Also, the independent claims 10-17 teach the use of a sub-expander, provided either in parallel to an expander, or/and at an expander's discharge/suction side, having an electric generator connected to said sub-expander.

2. U.S. Patent 6,612,117 to Kasmer teaches a heat pump utilizing a hydristor, which comprises a first compressor half and a second expander half, however it does not contain a four-way valve and an auxiliary compressor enabling the power recovery by said expander.

Transcritical CO₂ Cycle Technology" 2002 SAE Automotive Alternate Refrigerant Systems Symposium, July 2002, pages 1-17 by Joo Seok Baek et al. teaches a refrigeration cycle employing a CO₂ refrigerant with an expander connected to the compressor, having an auxiliary compressor at the second stage, however it does not use four-way valves to switch the fluid flow and enable power recovery by said expander. Finally, U.S. Patent 5,711,163 to Uchikawa et al.

Art Unit: 3744

teaches a compression heat pump having a compressor, an expander means, a plurality of heat exchangers and cooling-medium (refrigerant) route switchover means. It does not have an auxiliary compressor for the second stage compression, which enables the power recovery by said expander. The use of a sub-expander or an auxiliary expander to an expander, working in parallel with an expander has not been encountered in prior art, other than in U.S. Patent 6,606,860 to McFarland (184, FIG. 3). Another term for a sub-expander is a sub/auxiliary decompressor, which is used in U.S. PGP 2004/0123621 to Okaza et al., however, the element is not directly connected to the expander/decompressor, but to a compressor (47', FIG. 10).

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Art Unit: 3744

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Filip Zec whose telephone number is (571) 272-4815. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Denise Esquivel can be reached on (571) 272-4808. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Filip Zec
Examiner
Art Unit 3744


CHERYL TYLER
SUPERVISORY PATENT EXAMINER

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